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Radiopurity of Atmospheric Argon

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Argon is commonly used in particle physics experiments due to its convenient ionization and scintillation properties. The high abundance of 1% in the earth atmosphere also makes it easy and cheap to procure in large quantities. Recently, atmospheric liquid argon (LAr) is successfully used in low background experiments as a target to detect dark matter (e.g. DEAP-3600) or as shielding material in neutrinoless double beta decay experiments (GERDA, LEGEND-200).
As a noble gas, argon is easy to purify from radioactive contaminations which was recently demonstrated by the DEAP-3600 experiment achieving the lowest Rn222 concentration in a large noble liquid detector of 0.15 uBq/kg. However, the cosmogenically produced radioactive isotopes Ar39 and Ar42 pose a problem for low background experiments and have to be well understood. Ar39 with about 1 Bq/kg and a beta decay endpoint of 560 keV poses a significant background for low energy WIMP searches and the daughter of Ar42, K42, with about 100 uBq/kg and 3.5 MeV beta endpoint is a gamma ray and beta background for experiments using LAr as shielding. I will discuss the intrinsic radiopurities of atmospheric argon, including recent measurements and methods of mitigation in analyses.
Furthermore, in the low background environment of current experiments, one can investigate certain argon isotopes with unprecedented precision which allows extracting interesting physics. I will briefly discuss ideas to extract nuclear structure information with precision measurements of the 1st forbidden unique shape of Ar39 and to measure the half-life of double electron capture in Ar36.

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